Spatial Variation of Surface Residual Stress in Metallic Materials

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ABSTRACT

Shot peening is commonly used to reduce fatigue failures in industrial parts by introducing compressive residual stress into the surface of a material. However, it is challenging to assess the performance of the parts without destroying them. Solving this problem requires a combined model that predicts both recrystallization and residual stress using experimental measurements and predictive computational modelling. Experiments were performed to prove that the surface properties of materials after thermal treatments can be accessed, and the spatial variation of residual stress in metallic materials, including the relationship between surface and subsurface behavior can be evaluated. This process involves investigating the surface residual stress profile using a spatially sensitive X-ray diffraction technique, followed by other procedures such as cutting and investigation of microstructure and subsurface residual stress. With a model like this, the performance of industrial parts can be assessed in a non-destructive way. It is crucial that the parts can still serve the original purpose after being tested.

KEYWORDS

Shot peening, residual stress, predictive model, non-destructive testing.